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Title: FY 2021 LANL Agenda Non-Nuclear Production Mission

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Intended for: Request ability to share brief with NNSA offices as NNPO develops the
LANL non-nuclear production strategy (Task under 1.2 of the FY 2021
LANL Agenda).
Report

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FY 2021 LANL Agenda Non-Nuclear Production Mission

Strategy Development

Patrick Garcia, NNPO

Kevin Saeger, PF

David Armstrong, DP

Michael Stoll, WMP

August 9, 2021



Strategy Development Kick-off Session

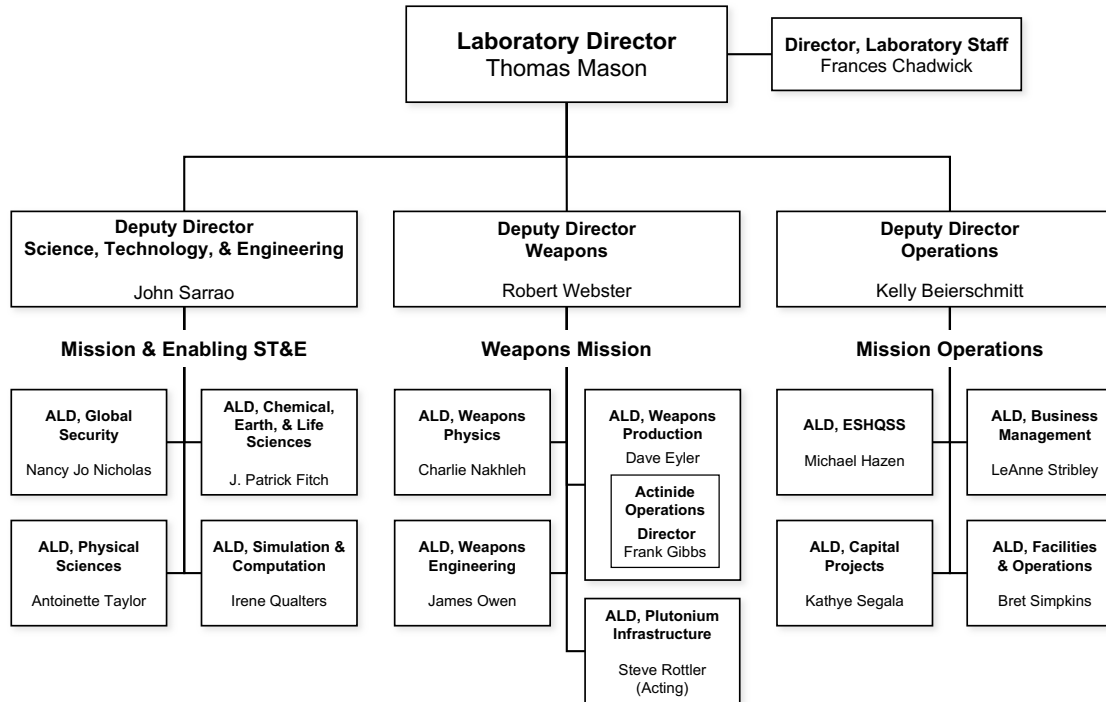


**Weapon
Modernization
Production**



- Introductions
- LANL Agenda
- Prototype Fabrication
- Detonator Production
- Line of Inquiry
- Path Forward

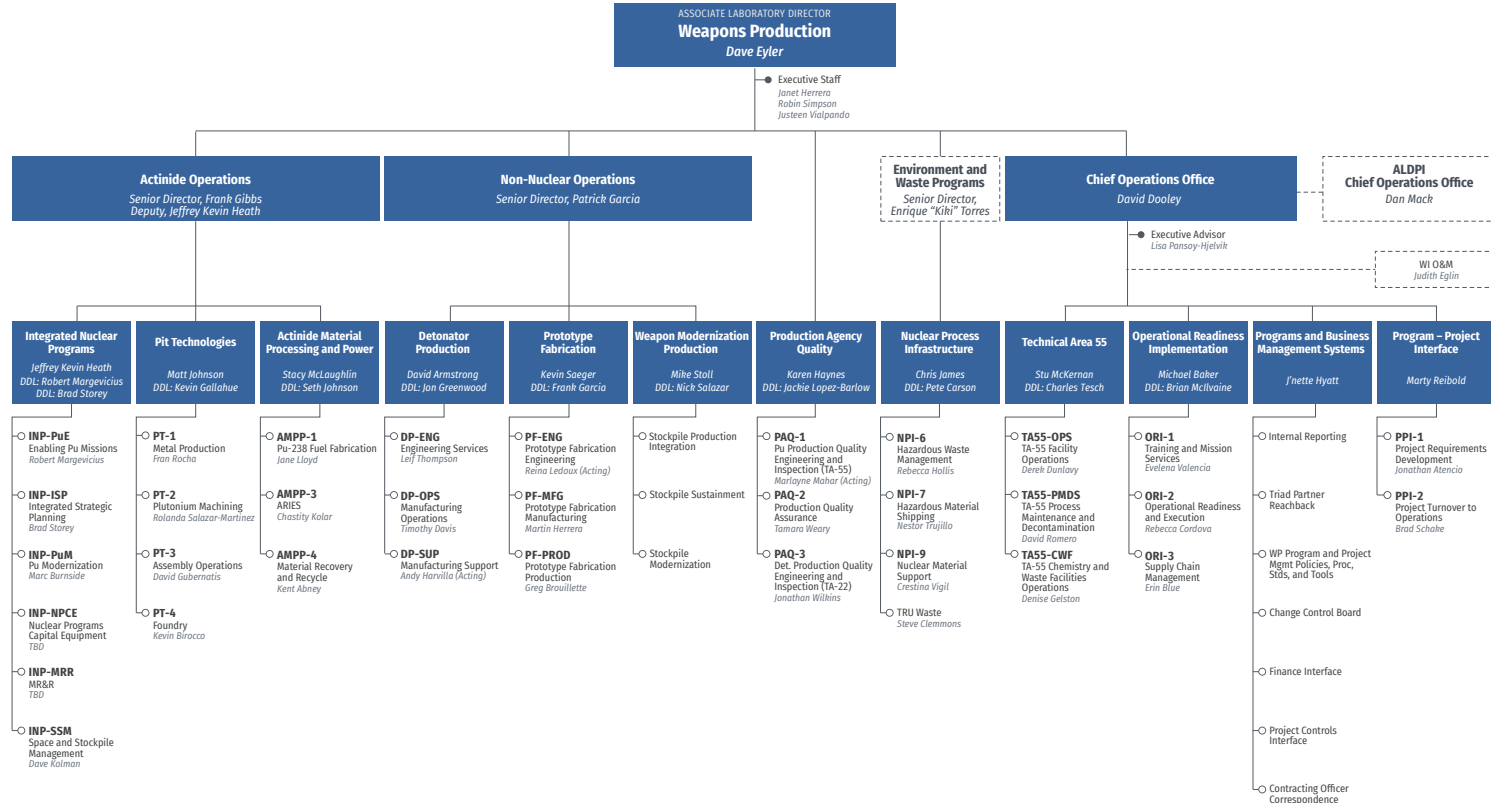
Los Alamos National Laboratory



06/15/2021

ASSOCIATE LABORATORY DIRECTORATE

Weapons Production



6/29/2021

FY 2021 LANL Agenda

SIMULTANEOUS EXCELLENCE	1.0 NUCLEAR SECURITY	2.0 MISSION-FOCUSED SCIENCE, TECHNOLOGY, AND ENGINEERING	3.0 MISSION OPERATIONS	4.0 COMMUNITY RELATIONS
Strategic Objective (10–25 years)	Excellence in Nuclear Security	Excellence in Mission-Focused Science, Technology, and Engineering	Excellence in Mission Operations	Excellence in Community Relations
Critical Outcomes (5–10 years)	Design, produce, and certify current and future nuclear weapons and reduce global nuclear threats	Deliver scientific discovery and technical breakthroughs that support DOE and NNSA missions	Execute sustained operations that are reliable and responsive to mission needs	Sustain and enhance LANL's partnership with the community across the Northern New Mexico region
Major Strategic Initiatives (1–5 years)	1.1 Execute LANL's Manufacturing mission to deliver 30 plutonium pits per year 1.2 Transform nuclear weapons warhead design and production 1.3 Anticipate threats to global security; develop and deploy revolutionary tools to detect, deter, and respond 1.4 Support modernization of LANL warhead systems 1.5 Assess the stockpile as it ages and project weapon system lifetimes	2.1 Refine and enhance the LANL capability pillar framework 2.2 Advance accelerator science, engineering, and technology to enable future stewardship capabilities 2.3 Advance the frontiers of computing to exascale and beyond 2.4 Assert leadership in the national quantum initiative 2.5 Develop and implement an integrated nuclear energy and nuclear materials initiative 2.6 Implement an integrated initiative for plutonium and actinide missions based on FY20 strategy 2.7 Implement a national security life sciences initiative	3.1 Change organizational culture with an emphasis on organizational learning 3.2 Improve integrated planning across priority mission activities and infrastructure 3.3 Address critical issues related to NMCA, nuclear safety, criticality safety, waste, and classified enhancements 3.4 Implement systematic process improvement to drive increased rigor and efficiency in work execution 3.5 Enhance quality of work life, workforce planning, and training and development	4.1 Continue commitment to the community with educational, economic, and philanthropic investments of time and resources 4.2 Strengthen pipelines and partnerships to build the workforce of the future 4.3 Enhance small business participation in executing LANL scope across all directorates 4.4 Demonstrate agility and flexibility in our partnerships, effectively balancing benefit and risk
Champion	Bob Webster	John Sarrao	Kelly Beierschmitt	Frances Chadwick

FY 2021 LANL Agenda

1.2 Excellence in Nuclear Security: Transform Nuclear Weapons Warhead Design and Production⁶

Responsibility

Bob Webster, Charlie Nakhleh, Dave Eyler, James Owen

Key Actions

- Support the stockpile beyond stewardship, including
 - Advance modularity concepts for future stockpile (**Lead: James Owen**)
 - Advance the Next Generation Warhead through the Phase X process (**Lead: James Owen**)
 - Vigorously execute the Stockpile Responsiveness Program (**Lead: Charlie Nakhleh**)
 - Develop the advanced tools needed for certifying and qualifying future options (**Lead: Charlie Nakhleh**)
 - Enable rapid manufacturing of pits and cases (**Leads: James Owen, Frank Gibbs, Charlie Nakhleh**)
 - Develop, publish, and socialize a modern nuclear explosive package certification plan (**Lead: Charlie Nakhleh**)
- Develop and prototype integrated Design for Manufacture approaches in weapon design, engineering, and production (**Leads: Charlie Nakhleh, Frank Gibbs, James Owen**)
- Deliver on components of the Director's Strategic Resilience Initiative (**Lead: John Scott**)
- Develop the non-nuclear production mission, including required strategic infrastructure and personnel; synergistic with 1.1 and 2.6 and NSE needs (**Lead: Patrick Garcia**)

Prototype Fabrication



Prototype Fabrication is the Centerpiece of a Larger Machining Enterprise at Los Alamos

- Pit Production
- Pu Machining
- HE Machining
- SIGMA
- Conduit to Commercial Shops



Prototype Fabrication has a Long and Proud History of Supporting the National Security Enterprise



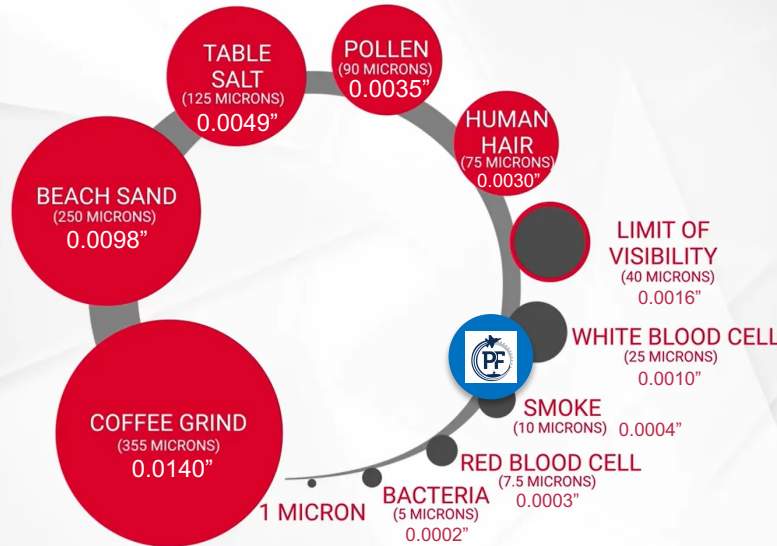
Main Shops
1968

Prototype Fabrication Tools of the Trade in 2020

Mazak I300



Required Precision



Leitz PMM-Xi



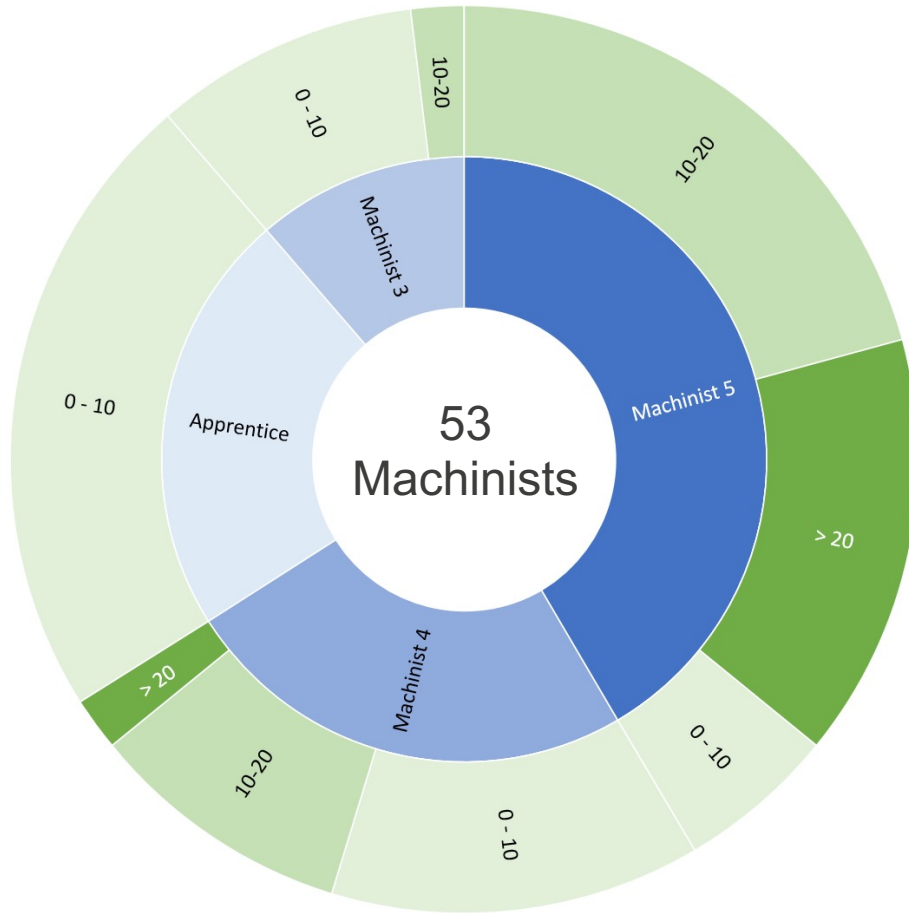
Unique Capabilities Within Prototype Fabrication

- Beryllium machining and inspection
- Depleted Uranium machining and Inspection
- High-precision machining and inspection of classified components
- Ultra-high precision measurement to include non-contact probing systems
- User-Performed Calibration for inspection equipment to include maintenance, calibration, and certification
- Machinist Pipeline Program
- Rapid prototyping and low quantity production
- Agile response to mark quality production requests

Non-Unique Capabilities Within Prototype Fabrication

- Mark Quality Manufacturing Center
- High Precision Shell Manufacturing
- End-to-End Programming Support from Creo Models through PDM Link to Machine Tool Programs
- Production Support (MRP, maintenance, document control, etc.)
- Welding
- Extensive vendor base
- Metrology Lab Space

Enabling Capability: Large, Experienced Machinist Pool with Relevant Experience

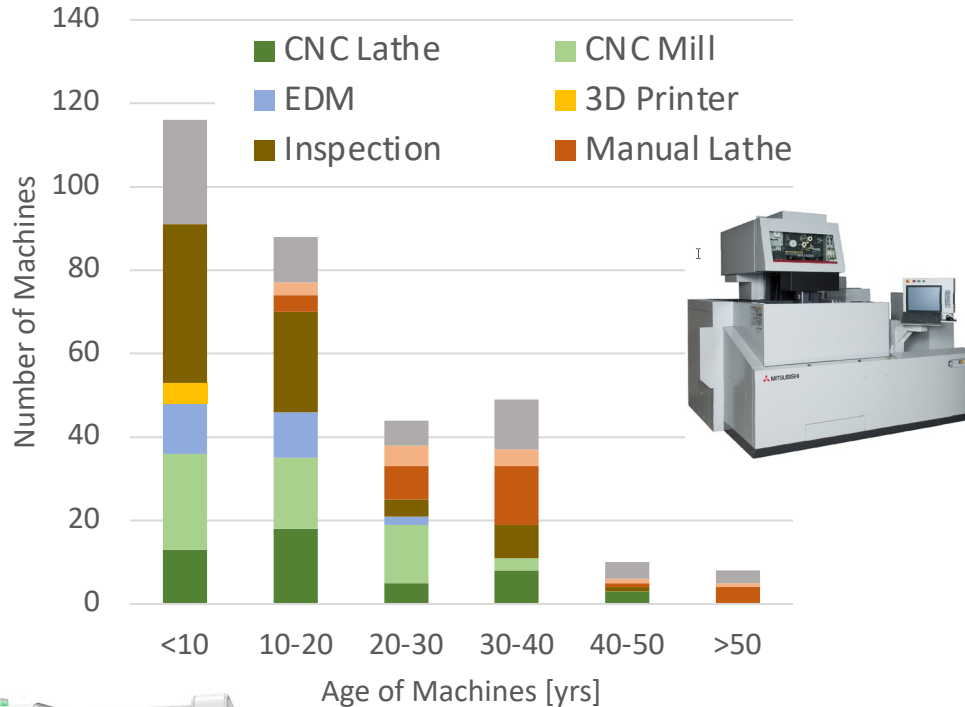


22 Machinist 5
(Senior-Most Journeymen)

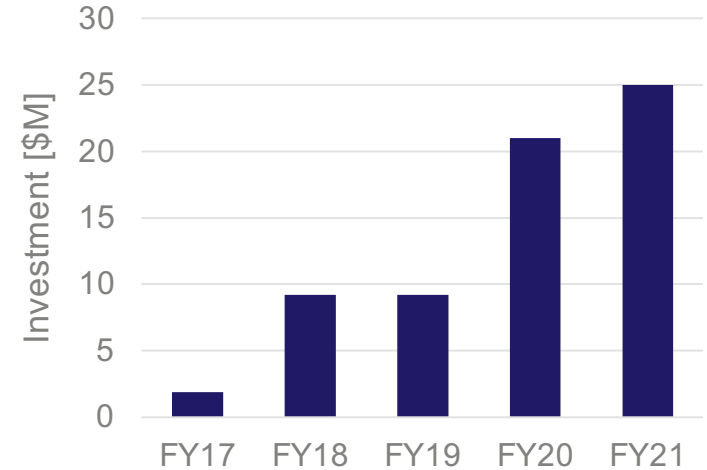


9 Machinists with over
20 years experience at
Los Alamos

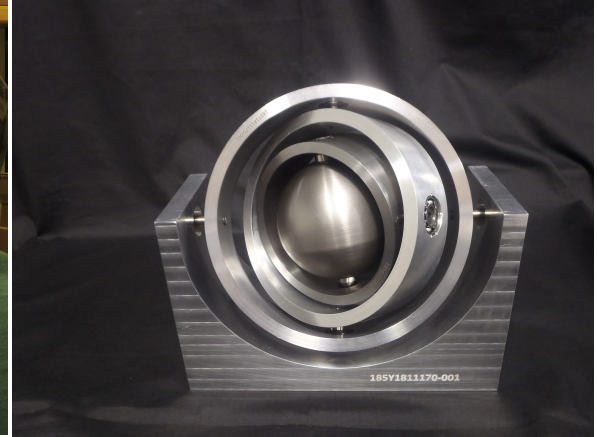
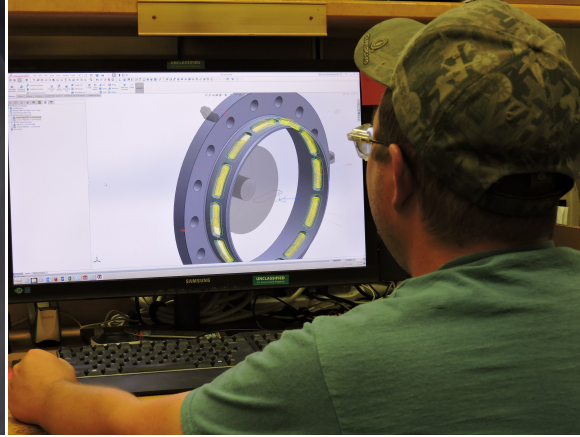
Enabling Capability: Modern Machining Platforms



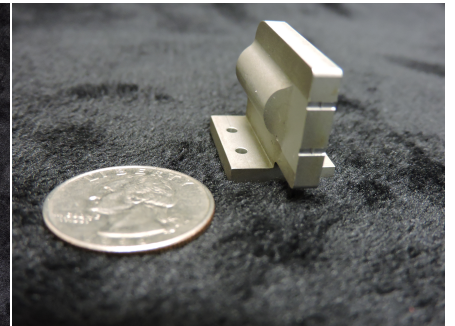
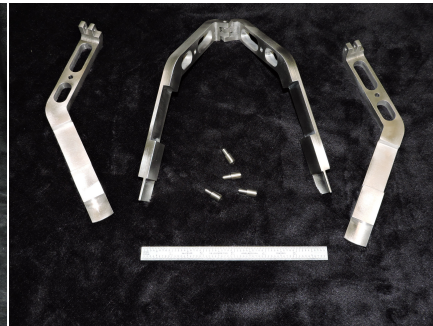
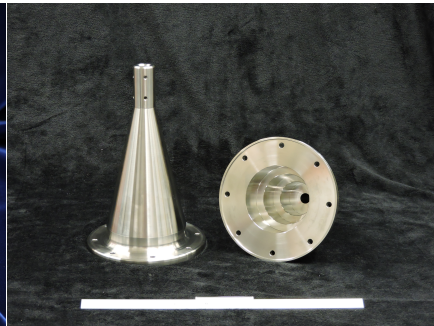
Infrastructure Investment



Enabling Capability: Extensive Experience With Precision Machining of Difficult Material



Extensive Experience with Be, Ti, Ta, W, DU and Specialty Steels



Mark Quality Manufacturing Center (MQMC)

Converted Document Storage Vault



Into a Modern Machine Shop



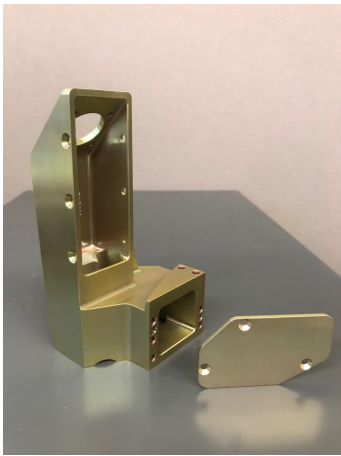
All Equipment
in Place and
Operational



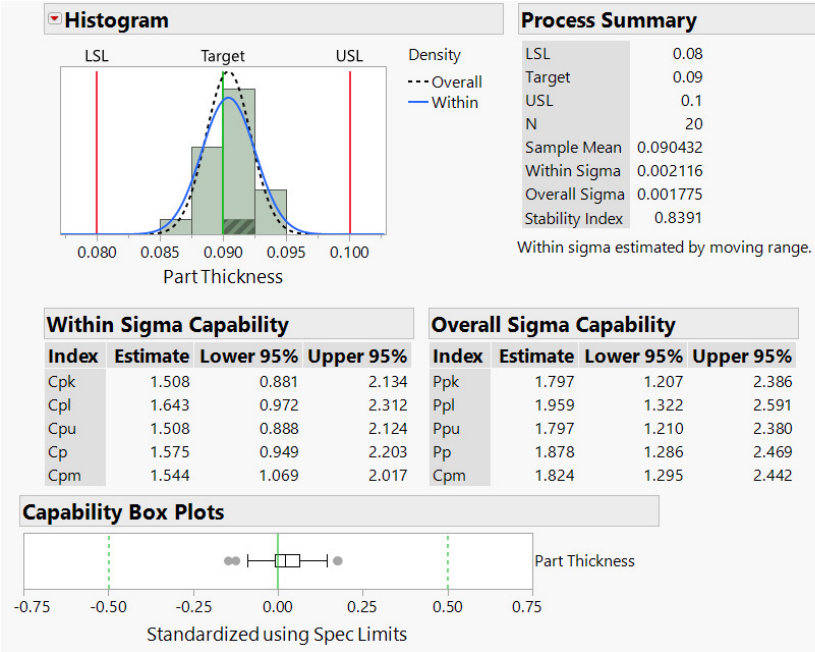
New Inspection Laboratory Ready for
Equipment Installation



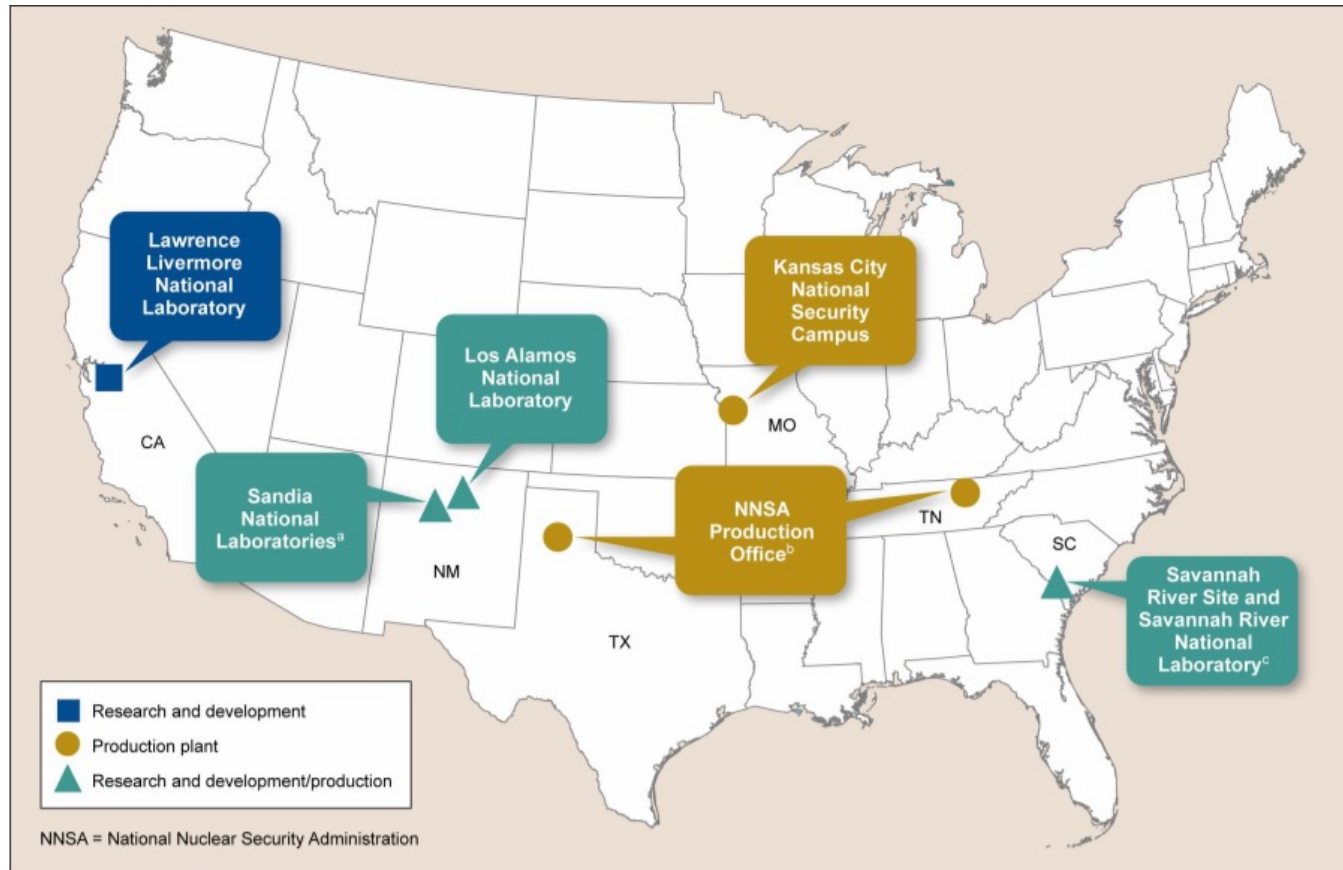
MQMC is Combining Skilled Machinists, with Modern Platforms, and Process Monitoring to Produce Exceptional Parts



Snorkel Cover Part Thickness



Prototype Fabrication at Los Alamos is Positioned to Provide Production Support to the NSE



Sources: Department of Energy; Map Resources (map). | GAO-18-129

Detonator Resources, Capability and Capacity Discussion



**Detonator
Production**

Agenda



- **Detonator Production Program Overview**
- **Mission Assignment Discussion**
- **Recent Investments**
- **Technology Centers**
 - High Explosives
 - Cables and Circuits
 - Headers and Chips
 - Inspection and Test
 - Production Support
- **Potential Growth Areas**
 - Actuators
 - Optical Detonation Train
 - Other

The LANL Detonator Production Enterprise (DPE) is Critical to Defense Programs

Mission Assignments

Detonator Production

- B61 LEP (2 products)
- W76 Enduring Stockpile
- W78 Enduring Stockpile
- W80 LEP (2 products)
- W88 Refresh / Enduring
- W87-1 LEP (2 products)
- W93

Detonator Surveillance

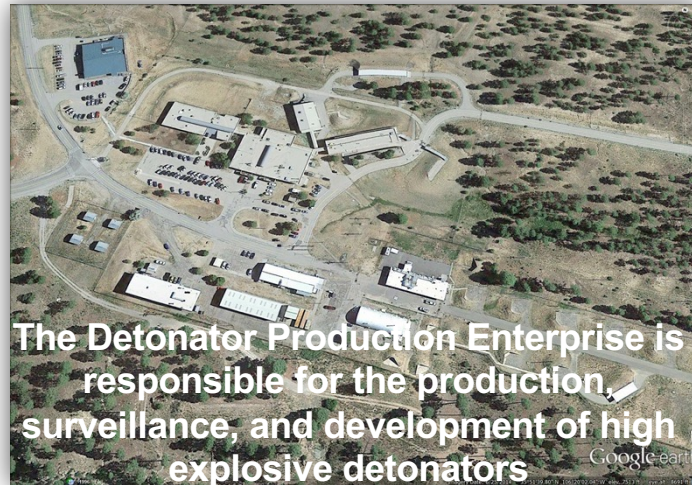
- All LANL systems

FFRDC Activities

- Hydros
- Advanced concepts
- Stockpile assessments
- Global security
- Weapon Response

DPE Infrastructure and Resources

- 17 Facilities
- 1000+ Pieces of Equipment (dedicated and shared)
- 140-150 Staff (engineers, technicians, professionals)
- Budget \$58M - \$64M / year



Mission Deliverables

Detonator Production

- B61 1E40 & 4E10
- W78 1E33
- W80 PCAs & MC5108
- W87 PCAs & MC5148
- W88 1E38
- W88 Alt940 (CF5011, CF5071, CF3652, CF3653, CF3654)

Detonator Surveillance

- Annual assessment

Detonator Research, Development & Testing

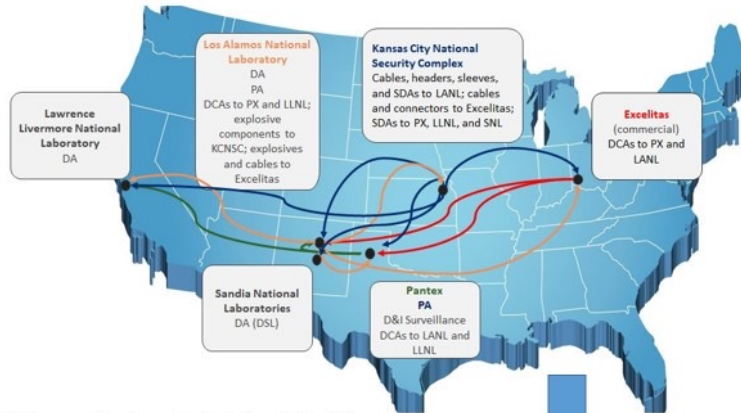
- Hydro cables & DCAs
- LEP development, certification, and qualification

The Consolidation of the Detonation Related Production Mission Yields Immediate Benefits to the NNSA

- Reduces the number of moves of materials, explosives, and classified assets during production through execution of production within a single security boundary
- Reduces the schedule dependencies tied to other NSE or commercial entities
- Reduces production overload at KCNSC
- Eliminates the production need to maintain high explosives inventories and operations along with required infrastructure and controls at KCNSC
 - eliminates the explosive hazard potential to co-located inert, non-nuclear operations at KCNSC
 - reduces technical and cross-programmatic operational risks to the NNSA

Detonator Production & Technology Center – 2030 +

Current State



* Multiple commercial vendors provide feedstock materials to LANL and KCNSC

Ideal State



* Select commercial qualified vendors provide feedstock materials to LANL

Given LANL's Definitive Explosives and Production Mission, we Offer an Option for all Detonation Related Components

- With its collection of R&D, manufacturing, and testing assets, LANL has more capability, flexibility, capacity, workload, throughput, and expertise for explosives than any other site within NNSA
- Detonator production draws on LANL wide resources in support of mission needs.
- Proximity and integration increases the benefits of teaming and collaborations among the DA and PA
- Aligns with modular design and manufacturing concepts
- Been able to offer NNSA options for nonnuclear production where schedule didn't meet customer needs
- LANL can be successful in provided nonnuclear production options given the right level of time and planning

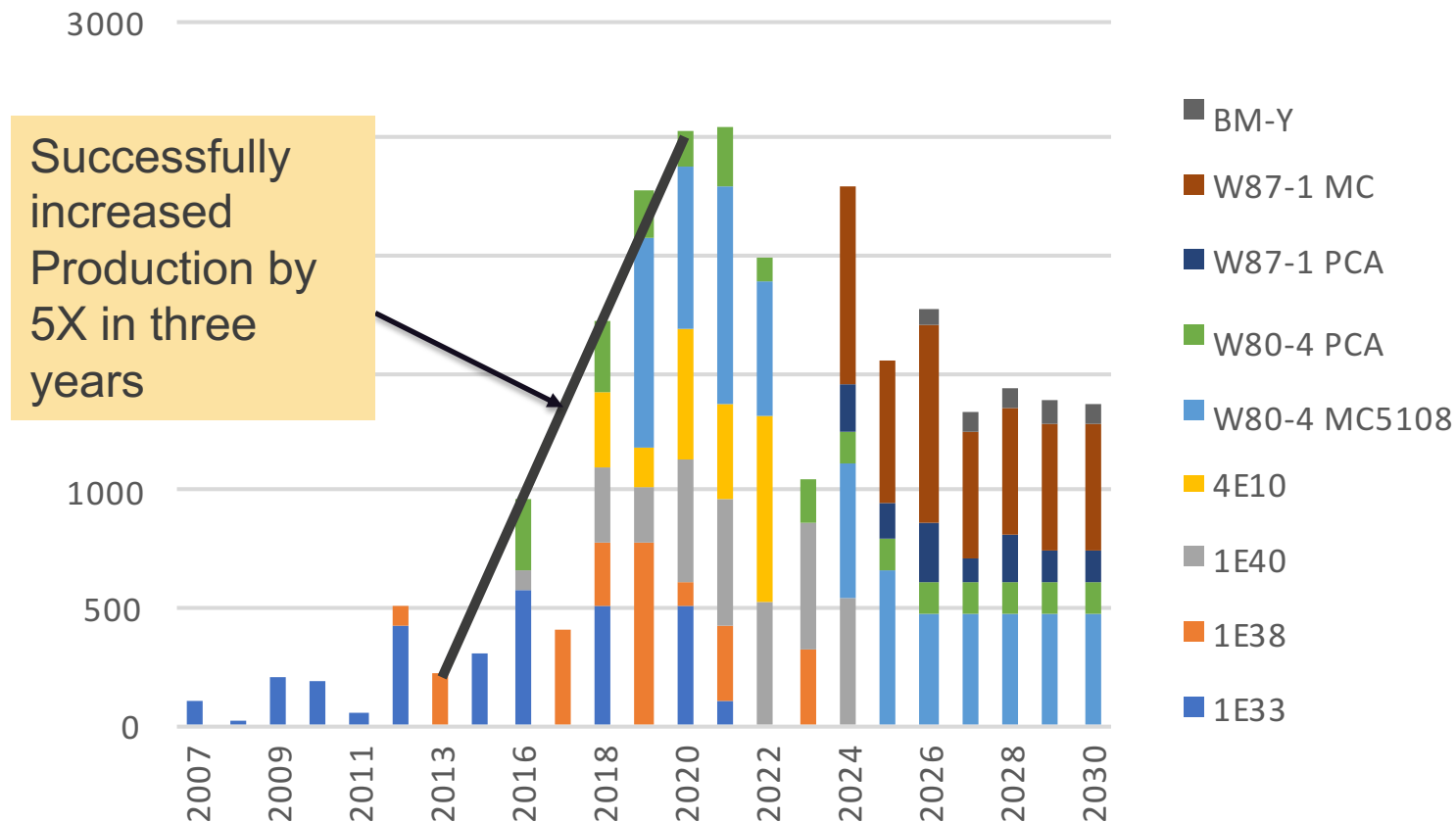
Modernization tasking investments have enabled us to be responsive to R&D and other development programs in addition to production.

Approximately \$20M Has Been Invested at TA-22 Over The Last 5 Years

- Computed Tomography
- Explosive Presses
- Automated Powder Dispensers
- Laser Welding
- Laser Drilling / Cutting
- Photolithography
- CMM / OMM
- Building 189
- Glassing furnaces
- Coating
 - PVD
 - Electro-less
 - Spin



Investments Combined with Continuous Improvement Culture Used to Drastically Increase Production Quality and Throughput



Unique and Non-Unique Capabilities Within Detonator Production

- Unique capabilities

- High power detonator manufacturing

- Explosive (PETN) synthesis and characterization
 - Explosive pressing and assembly
 - Classified operations within multiple VTRs
 - Rapid response (engineering test, SFN)
 - High accuracy and performance
 - Live fire performance testing (test fire)
 - Detonator shipping container design, qualification, and supply

- Non-unique capabilities

- Production Support (MRP, maintenance, document control, etc.)
 - Detonator cables, connectors, and components
 - Inspection and test

Enabling Capabilities Supporting High Power Detonation Related Production

- High Explosives Operations
 - PETN powder production
 - Explosive pressing
 - mg accuracies
 - .02 g – 30 gram scale
 - Detonator assembly
 - Crimping
 - Gluing
 - welding
- Cables and Circuits
 - Photolithography
 - Pressing
 - Soldering
 - Welding
 - Laser cutting and marking
 - Optical fiber

Enabling Capabilities Supporting High Power Detonator Production

- Headers and Chips
 - Glassing
 - Molding
 - Additive Manufacturing
 - Coating (SIGMA)
 - Machining (PF)
- Production Support
 - Warehousing
 - MES
 - Packaging and Transportation
 - Supply Chain
- Inspection and Test
 - CT
 - CMM
 - OMM
 - Electrical Testing
 - Test Fire

Lines of Inquiry

- Is there enough detail in the information presented to understand DP/PF capabilities?
- What are your program needs today? Do you see changes coming?
- How can we help meet your current and future needs?
- Are you relying on other sites in NSE or outside vendors?
- Current recharge or cost estimates comparison to outside a factor?
- What is the desired state of NN manufacturing at LANL for your success? Is it sustainable through your portfolios?
- What other manufacturing processes are needed? Space? Infrastructure? Equipment?
- Should other/more Directive Schedule or SPP work be pursued?
- Should more manufacturing capacity be pursued for development efforts?

Path Forward

- Lines of Inquiry slide will be distributed for further review
- Comments and feedback are welcomed
- Schedule 1:1 or small group WebEx session for specific portfolio needs
 - Discuss if need for in-person sessions (classified/sensitive)
- Schedule potential group session for status
- Draft strategy structure / documents for review
- Revision 1 released EO 2021

Enabling Capability: Continuing Investment in Process Innovation

The first Single Piece Blast Hardware (unclassified design shown) was designed and fabricated on the new Mazak i300.

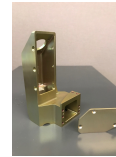
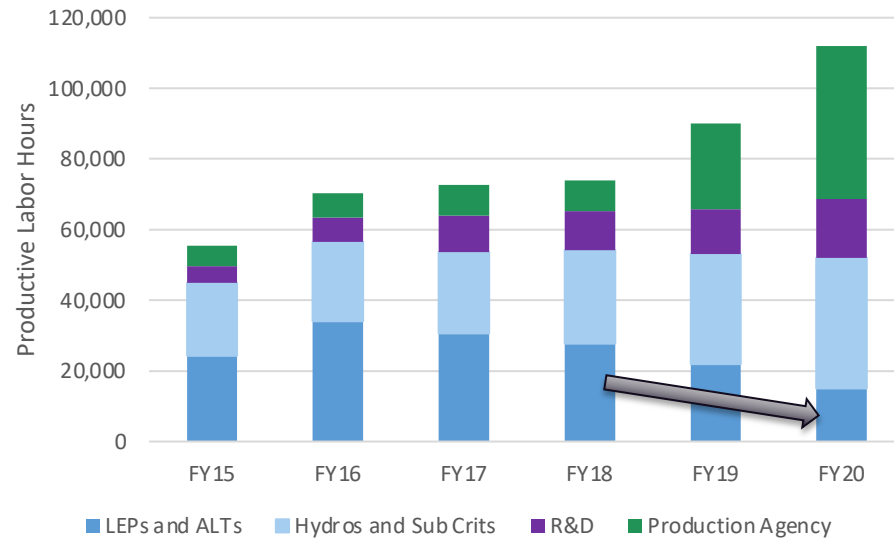
- Reduced fabrication and inspection time by over 50%.
- The first DU Single Piece was fabricated and was used for Hydro Test 3680.

Comparison of DU Blast Hwd Fabrication and Inspection Hours

Baseline	Time	New Machine	Time	New Machine/ New Process	Time
First 2-piece Blast Pipe using HAAS		Second 2-piece Blast Pipe using Mazak i300		1-Piece Blast Pipe using Mazak i300	
Inner Saddle	362	Inner Saddle	170		
Blast Shield	198	Blast Shield	58		
Inner Saddle/Blast Shield Assembly	207	Inner Saddle/Blast Shield Assembly	198		
				Inner Saddle/Blast Shield	297
Total Hours	767		426		297



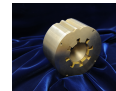
Precision Machining Operations at Los Alamos Surged to Meet Demand



ALT 940

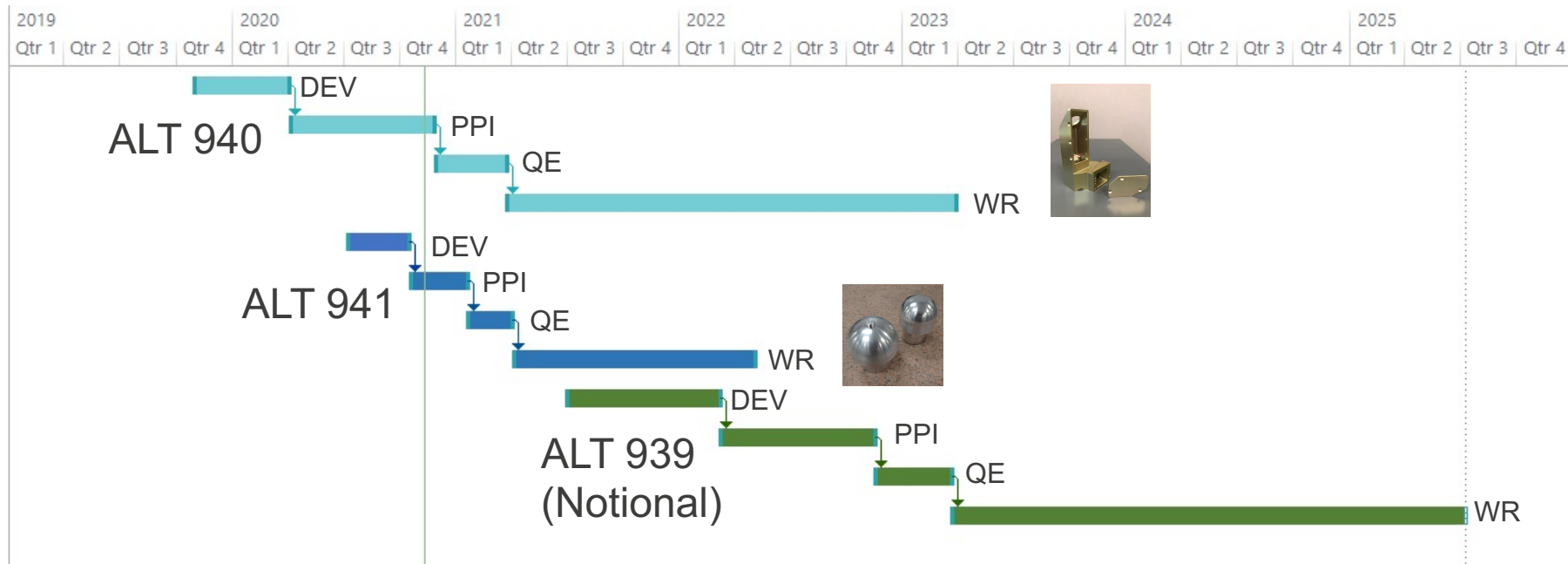


LDRD-funded Blast Tube



DARHT Collimator

Non-Nuclear Production Missions are Expanding



Prototype Fabrication Is Contributing to Mark Quality Components Today